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A Methodology for Understanding Niche Incompatibilities in Agroforestry

Incompatible trees on farm and forest boundaries were found in Ethiopia, Kenya, Tanzania and Uganda, and are thought to have negative economic consequences for neighboring farmers whose crops suffer through competition with trees for light, water and nutrients or allelopathic interactions.

Trees are generally assumed to be ecologically benign and socially neutral. Yet when planted in the wrong places, trees can have strong negative effects on the environment and certain resource users, requiring that methods to enhance niche compatibility be developed and institutionalized.

The integration of trees into smallholder farming systems has been extensively promoted in recent decades as a means to enhance farmer incomes from diverse tree products while conserving soil, water and biodiversity and sequestering Carbon. There is a tendency to treat (agro)forestry as a largely technical enterprise with only positive social and environmental consequences. Yet the interactions between trees and other system components (and resource users) are significant, and can be both positive and negative. There is a critical need to institutionalize an emphasis on system compatibility in (agro)forestry practice, beginning with the identification of trees that are incompatible with specific landscape niches. This brief describes a methodology developed under the rubric of the African Highlands Initiative for using local knowledge to identify landscape niches where trees are causing problems. It discusses how these findings may be applied to foster positive rather than negative interactions between trees and other system components (crops, water, livestock, soil), and between diverse resource users (tree cultivators and others), in agroforestry.

Methodology for Tree Niche Analysis

The following steps are followed in the identification of niche incompatibilities in agroforestry:

1. Focus group discussions by gender, age, wealth and landscape position to identify major problems in the system (*Do trees cause any problems? Is the methodology needed?).*

2. Focus group discussions with key informants knowledgeable about native and exotic species to identify: a) diverse niches where trees are or could be grown; b) culturally-important, harmful and niche-compatible species; and c) the *properties* of trees that make them culturally-important, harmful and niche-compatible.

3. Compilation of a matrix of tree species and properties identified in Step 2, asking key informants to rank each species according to the degree to which it exhibits each property ("yes"=2, "somewhat"=1, "no"=0).

4. Analysis of the resulting matrix using descriptive statistics (Table 1);

FOLK GENUS:	AGROCARPUS	MKOSOGHOO	MSONGOMA	MLOBE	MKARATUSI	MKUYO	MSAMBO
I. Farm Boundaries							
Does not create much shade	1	0	1	2	2	0	0
Makes good firewood	2	2	2	2	2	2	2
Doesn't produce edible fruit	2	0	2	0	2	2	0
Not a heavy feeder on water	2	1	2	2	0	2	2
Leaves not bad for crops, soil	2	1	2	2	0	2	0
Average:	**1.8**	**0.9**	**1.4**	**1.1**	**0.9**	**1.3**	**0.8**
II. Forest Margins							
Does not arrest undergrowth	2	1	2	2	2	2	2
Leaves not bad for crops, soil	2	1	2	2	0	2	0
Is not a heavy feeder on water	2	1	2	2	0	2	2
Does not kill other tree species	2	2	2	2	0	2	2
Is not indigenous	2	2	2	0	2	0	0
Average:	**2.0**	**1.4**	**2.0**	**1.6**	**0.8**	**1.6**	**1.2**

Table 1. Sample matrix with tree species classified by niche

NICHE	COMPATIBILITY CRITERIA [1]	INCOMPATIBLE SPECIES [2]	MOST COMPATIBLE SPECIES
1. Farm Boundaries	• **No adverse effect on adjacent crops** • Branches can be cut for fuel wood • Good for soil erosion control • Serves as feed for livestock • Good for shade • Makes a good fence • Good source of income	• *Eucalyptus globulus* • *Cupressus lusitanica* • *Senecio gigas* • *Rahmnus prinoides* • *Podocarpus gracilor* • *Juniperus procera* • *Olea africana* • *Erica arborea*	• *Buddleja polystachya* • *Dombeya torrida* • *Hagenia abyssinica* • *Acacia decurrens* • *Chamaecytisus palmensis* • *Maesa lanceolata* • *Hypericum quartinianum*
2. Springs and Waterways	• **No negative effect on spring discharge** • **Does not change the taste of water** • Has a shallow root system • Creates a good shade	• *Cupressus lusitanica* • *Eucalyptus globulus* • *Olea africana* • *Senecio gigas* • *Vernonia auruculifera*	• *Salix subserata* • *Juniperus procera* • *Hagenia abyssinica* • *Maesa lanceolata* • *Olea africana* • *Podocarpus gracilor*
3. Outfields	• **No negative effect on crops** • Good for soil fertility • Has shallow root system • Good source of income • Has a good shade • Good for soil erosion control • Young trees survive browsing	• *Cupressus lusitanica* • *Eucalyptus globulus*	• *Dombeya torrida* • *Hagenica abyssinica* • *Juniperus procera* • *Podocarpus gracilor*
4. Degraded Areas	• Has beneficial effect on soil fertility • Deep rooted • Fast growing • Not suitable for other niches		• *Buddleja polystachya* • *Dombeya torrida* • *Eucalyptus globulus* • *Hagenica abyssinica* • *Vernonia auruculifera*

Table 2. Niche compatibility findings from Ginchi benchmark site, Ethiopia. [1] Compatibility criteria in bold font are those critical to other stakeholders or system components, and therefore the only criteria used to assess incompatibility. The most compatible species were identified through consideration of all identified compatibility criteria. [2] Underlined species are exotics.

5. Comparison of qualitative (focus group) and quantitative (ranking) data to identify discrepancies, using focus group discussions to understand reasons for discrepancies. Reasons might include failure to identify certain niche compatibility criteria or tree species during focus group discussions, or failure to give a relative weighting to identified compatibility criteria.

Sample Findings

Niches found to require improved management in AHI benchmark sites of Ethiopia, Kenya, Tanzania and Uganda include:

- Springs (all sites)
- Waterways (all sites)
- Farm boundaries (all sites)
- Roadsides (Tanzania, Uganda)
- Outfields (Ethiopia)
- Degraded areas (Ethiopia, Uganda)
- Protected area boundaries (Tanzania)

Findings from Ginchi benchmark site, Ethiopia, illustrate how local knowledge can be used to target interventions based on the most incompatible species by niche (Table 2).

Applications of the Approach

These findings have been used in a number of ways that highlight promising avenues for strengthening the emphasis on niche compatibility within institutionalized (agro)forestry practice:

1. To identify and promote appropriate species by niche for niche-targeted afforestation; and

2. To improve the governance of trees within densely settled agricultural landscapes by:

✔ Identifying local stakeholders within each niche where trees were found to cause problems (i.e. tree owners and the affected parties);

✔ Negotiation support to enable stakeholders to identify more optimal species for the niche in question (i.e. those that maximize the landowners' production goals while minimizing the negative effects on other system components or users); and

✔ Local-level policy reforms to strengthen resolutions reached through multi-stakeholder negotiations.

Such interventions targeting niche compatibility ensure that tree and woodlot owners do not think solely about their own benefits from trees, but consider also the impacts of their land use practices on other system components and resource users. Ultimately, the methodology should help to enhance multiple system benefits while minimizing the negative impact of trees on certain stakeholders.

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